

# **A PRESCRIPTION FOR FOREST HEALTH**

**Mountain Pine Beetle Initiative Outreach Program  
Alberta and British Columbia Grade 7**

The Mountain Pine Beetle Initiative is administered by  
Natural Resources Canada and the Canadian Forest Service

# **A PRESCRIPTION FOR FOREST HEALTH**

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## **Title: A Prescription for Forest Health (In-Class Lesson)**

### **Overview:**

*“Forests within our mountain national parks are becoming less diverse. There is a gradual aging of forests, significant accumulations of forest fuels, and loss of important wildlife habitat.”*  
National Park Management Plan

In this lesson, students will examine forest health, learn to detect symptoms of a healthy and an unhealthy forest ecosystem, and learn how fire contributes to the overall health of a forest.

### **Province and Grade Level:**

British Columbia Grade 7

Alberta Grade 7

### **List of the Province/Territory and the Related Curriculum Expectations/Competencies/Outcomes:**

British Columbia Grade 7: Life Science – Ecosystems

- analyze the roles of organisms as part of interconnected food webs, populations, communities and ecosystems
- assess survival needs and interactions between organisms and the environment
- assess the requirements for sustaining healthy local ecosystems
- evaluate human impacts on local ecosystems

Alberta Grade 7: Interactions and Ecosystems (Social and Environmental Emphasis)

- investigate and describe relationships between humans and their environments, and identify related issues and scientific questions
- trace and interpret the flow of energy and materials within an ecosystem
- monitor a local environment, and assess the impacts of environmental factors on the growth, health and reproduction of organisms in that environment
- describe the relationships between knowledge, decisions, and actions in maintaining life-supporting systems

### **Learning Expectations/Competencies/Outcomes for the Lesson Plan:**

Through brainstorming, observation and analysis, students will examine the role natural disturbances play in maintaining healthy, functioning forest ecosystems. Students will become “forest doctors” discovering symptoms of unhealthy forests.

**Duration:** 45 minutes

**Required Materials:**

## Introduction

- ❑ photos

## Fires for Forest Health

- ❑ photos
- ❑ script

## Reader's Theatre: Forest Fever

- ❑ scripts put into duotangs
- ❑ picture of beetle galleries

## **Teacher Information:**

Fire is a disturbance that has been around for a long time. It has been part of grassland, brush and forest ecosystems for as long as they have existed. Like storms, avalanches and floods, it is a powerful force of change in nature. Fire has shaped landscapes across Alberta, British Columbia, Canada and around the world.

Many ecosystems have evolved with fire and depend on it for renewal. A recent burned area may seem dead but many forms of life survive, giving rise to a new forest. Fire kick starts regeneration by providing ideal growing conditions. In cool temperate areas, decay is slow and logs, leaves and needles pile up on the forest floor. Fire reduces this material to mineral rich ash, releasing and recycling nutrients. Fire also creates openings in the forest. Sunlight penetrates these gaps, warming the soil and stimulating new growth from seeds and roots.

Over time, periodic fires create a vegetation mosaic of different ages and types. This provides a rich variety of habitats that support many species of insects, mammals and birds. This is biodiversity. It indicates a thriving ecosystem that is likely to persist in the future. Fire not only renews and recycles but also rearranges vegetation in a continual cycle of change.

Many plants and animals are adapted to fires and the conditions they create. After a fire, woodpecker populations may increase fifty times. They come to feast on beetles and other insects that colonize the newly burned trees. Aspen, raspberry and rose sprout vigorously from underground roots after a fire passes. Moose and elk feed on the new growth. Both lodgepole pine and jack pine have resin sealed cones that can stay on the tree for many years. The heat of a fire melts the resin and the cones pop open. Thousands of seeds scatter onto the ground and grow into new stands of pine.

For the last ten thousand years, First Nations peoples have used fire to create grazing habitat and to keep travel routes open. In many areas, they influenced vegetation patterns. When Europeans arrived, they brought with them very different attitudes toward fire. Fire was dangerous and needed to be controlled. These attitudes resulted in forest fire suppression, leading to a change in the composition of our forests. Even national parks viewed fire as a destroyer. "Only you can prevent forest fires," cautioned Smokey Bear, who first appeared in the 1950s. Smokey's message, along with the development of modern fire fighting equipment and techniques, shut fire out of most of our ecosystems. For example, over the last 65 years, the area burned in the Rocky Mountain national parks has dwindled to less than 10% of historic levels. Most researchers agree that fire suppression is altering many ecosystems. Forests are becoming older and more closed in. The open habitats favoured by many species of wildlife are becoming more rare. Forests are losing the vegetation mosaic and the biodiversity it sustains. These mature forests are also more susceptible to disease and insect outbreaks and create more of a wildfire risk because of the buildup of fuel. The effects of fire suppression are far reaching, for they affect not only parks, but surrounding lands as well.

## Procedure:

### Introduction

National parks are special places where the main goal is to protect the natural environment. That means protecting the natural processes that keep ecosystems healthy. Natural processes are natural events like fire, forest insects, disease, floods, and avalanches that shape the landscape over time.

During this lesson we will take a close look at one of the natural processes – fire. We will see how fire is connected to forest health. What is Forest Health? It is easy to think that a forest is healthy if it has a lot of trees, but this isn't always the case. Just as a doctor needs to know a person's medical history to make a diagnosis, we need to understand the history of a forest to tell what is "healthy" for that forest. If all of the plants, animals and natural processes historically found in a forest are still present and functioning normally, then the forest is likely to stay healthy. If some of these pieces are missing or if others are added that weren't there when the forest was evolving, that forest becomes unbalanced, supporting fewer species of plants, animals, birds and insects.

Many of you have watched the news or heard about the many forest fires we have had in Canada in the last few years. Fire evokes many emotions and opinions. We will start our lesson off with a slide show. This will help us understand what your views are on fire and forest health. Take out a sheet of paper. For each slide, write down some observations or feelings. After viewing the slides, write down a few general observations and feelings about wildfires. There are no right or wrong remarks.

*Silently show slides:*

- lightning
- fire in full progress
- big horn sheep fire
- close up shot of tree burning
- blackened soil and trees
- growth after a fire

*Gather students' responses in a short brainstorming session. Encourage students to listen respectfully to others. Record their feelings on the front board or a flip chart.*

### Fire and Forest Health?

How many of you have grown up with the wise words of Smokey Bear? It was one of the most successful public education campaigns ever. The message is still important: you don't want to be the cause of forest fires. We stop forest fires for many reasons, even within our national parks. We need to protect human values like lives and homes, and recreational values like popular trails and campgrounds. We are starting to realize, however, that in stopping fires we have stopped a very **natural** and valuable process.

Do you think fire might play a role in forest health?

Forests have been evolving for thousands of years in North America in the presence of fire. There are many different kinds of forests. Within our mountain parks, there are a variety of forests with different fire histories. Some forests in the subalpine (higher up on the mountain slopes) burned every 200 to 300 years. Other forests that grow lower down in the valley bottoms are called **montane**. These forests were adapted to fire and burned every 15 to 25 years.

Montane = Prime Habitat

Montane is a term used to describe various plant communities that cover the valley bottom and lower slopes of the Rocky Mountains. Montane is essential habitat for wildlife, especially in the winter when higher elevation areas are covered in deep snow.

Let's take a look at fire and the role it plays in forest health. *Show slides with dialogue from the script.*

*Slide #1 – Slide of lightning*

*For thousands of years, lightning and Aboriginal peoples were the main source of fire ignition. Aboriginal peoples understood the benefits of fire. They used fire to create grazing habitat, herd game, keep travel routes open and stimulate the growth of berries and medicinal plants. In many areas, Aboriginal peoples influenced vegetation patterns. When Europeans arrived, they brought with them very different attitudes toward fire. Fire was dangerous and needed to be controlled.*

*Slide #2 – Low intensity fire*

This shows fire burning in the montane forest. Do you remember what a montane forest is? These forests were adapted to fire and burned every 15 to 25 years. Fires were predominantly low intensity (intensity = how hot the fires burned) because of how often they occurred. Frequent fires meant that there wasn't much material available to burn and the fires never got very hot. The hotter a fire burns, the longer it takes an area to grow back.

*Slide #3 – Bighorn sheep in forest*

During a fire, most large mammals will outrun the flames. In rare cases, large or severe fires may trap some animals. Deer, moose and elk are more abundant in fire-regenerated landscapes, but they also need older stands nearby for shelter. Bears prefer vegetation that grows in the early years after a fire.

Predators are affected by what happens to their prey. For example, lynx populations rise and fall with snowshoe hare populations. In the short-term, fire may reduce hare habitat, but as vegetation regenerates and more cover and food become available, snowshoe hare populations grow and lynx benefit.

*Slide #4 - Forest after an intense fire*

Immediately after a fire, the area might look completely dead; but as fire burns, much of the vegetation is turned into ash that remains on the forest floor. Fire recycles these nutrients, which

in turn promote new plant growth. The blackened soil after a fire absorbs heat and is rich in newly released minerals.

*Slides #5 – Pictures of newly emerging plants from ashes*

Hidden in the soil are roots and stems of plants and millions of seeds that find ideal growing conditions in the warm, mineral rich, post-fire soil. Some of the first plants up after a fire are flowers like arnicas, roses and fireweed. Aspens are often the first trees to colonize a site after the area has been burned. Trembling aspen reproduces by sending up suckers from its extensive, shallow root system.

*Slide #6 – Lodgepole pine seedlings*

Lodgepole pine is a relatively short-lived tree (seldom over 200 years) that thrives in areas periodically burned by forest fire. Although these thin-barked trees are easily killed by fire, their cones *require* heat to melt the resin that seals their scales shut. The cone scales open when the resin is softened by a rapid pulse of intense heat from a wildfire (or if exposed to warm summer temperatures for long periods). Once the resin bond has been broken, scales will open slowly over several days, allowing the wind to dislodge and distribute the inner seeds.

The cones and seeds of lodgepole pine are not usually consumed by wildfire because cones are subject to high heat from rapidly moving wildfires for only a few seconds or minutes. Also, a cone's internal temperature does not rise instantaneously when heated because its insulating properties resist heating, such that heat conducts slowly through the cone's outer surface. Following a fire, huge amounts of stockpiled seeds are released, producing dense stands of young trees.

*Slide #7 – Burned mosaic*

Fire actually jumps, burning the forest in patches. By burning in this manner, fire creates a diverse forest with stands of unburned older trees growing beside burned areas, opening the forest floor to sunlight and new growth.

*Slide #8 – Picture of a red beetle-killed forest*

National parks preserve examples of Canada's landscapes and the processes (such as disease and insects like mountain pine beetle) that create them. In the same way that vitamins can help to keep us healthy, natural processes can help to maintain forest health.

Forest health is complex. Imagine you were in charge of figuring out if a forest was healthy or not. What would your diagnosis be? What might you prescribe to remedy the situation? Our next exercises will put you in that position; some of you will be interns (doctors in training) and others will be the patients.

## Forest Fever: A Reader's Theatre

*This section is performed as a Reader's Theatre. It requires no rehearsal – performers need only follow the directions provided. Pick 'volunteers' who are good readers and comfortable speakers. Set up two chairs at the front of the class.*

Set Up Instructions (can be done in groups depending on the size of the class):

*Choose four students to be actors: Pinus Lodgepole, Fescue Grass, Barry the Black-backed Woodpecker, and Dirty Harry. You are Dr. Montane.*

- *Give students their scripts and allow them a minute or two to read over their highlighted lines. The words in italics are actions and should not be read. Their scripts should have only their own lines highlighted.*
- *Give students some motivation and ideas for acting out the characters, i.e., Pinus should be acting squirmy; Fescue should be acting nervous, always looking around; Barry should be smacking his lips and looking around for food; Dirty Harry should be acting macho showing his big attitude.*
- *Ask students to closely follow the script and jump in when it is their line.*
- *The cast can be seated in the class until called up by the doctor.*

The rest of the group has the very important role of being interns or doctors in training. They will record symptoms and information from the patients. After the interns have seen all of the patients, they will analyze their patients and see if they can come up with a treatment plan or a prescription for their patients' health.

## Forest Fever

**Dr. Montane:** Hello interns, I hope you've all studied for your medical exams. Today you will observe some patients. It is your role to write down their symptoms and think about possible treatments. We will go over them once the patients have left.

For our first patient, I will ask Pinus Lodgepole to come up to the front. Please have a seat. Now tell me, what brings you in today?

**Pinus Lodgepole:** *(Should be acting squirmy and not content to sit still).*  
Doc, something's been eating at me. I feel all creepy, it's gotten under my bark!

**Dr.:** When did you start to feel this way?

**Pinus:** Oh, this summer I felt a bit of gnawing, and I noticed I was pretty pitchy.

**Dr.:** Pardon me?

**Pinus:** Things have been eating at me and it's making me pitchy. You know, my sap squirts out and I "pitch" out these little black things.

**Dr.:** For the record, how old are you?

**Pinus:** 80 years old this summer.

**Dr.:** Are any other members in your surrounding forest complaining of similar symptoms?

**Pinus:** Come to think of it, at our last birthday party, everyone was complaining about it.

**Dr.:** OUR last birthday party? A few of you have the same birthday?

**Pinus:** Almost all of us in my forest are 80.

**Dr.:** I see. (*Pretends to scrape away some bark*). This won't hurt. I am just going to take off a little section of your bark to look at your nice living cambium layer. Ah-ha, you seem to have galleries in your phloem. They look a lot like this. (*Show a picture of galleries*). And I see some larvae. I am afraid you have a large infestation of mountain pine beetle.

**Pinus:** Tell it to me straight Doc. Have I got long to live?

**Dr.:** I'm sorry Pinus, but your days are numbered. By next summer, you will be dead, but probably standing dead. Don't worry. Your offspring will take over for you.

**Pinus:** Oh, I don't have any seedlings. It's too dark on the forest floor and so many of my seeds are stuck in hard cones. (*Get up and sadly go back to your desk*).

**Dr.:** I am sorry to hear that. Next patient please. Is there a Fescue Grass?

**Fescue:** (*Enter Fescue – acting very nervous, always looking around, tapping foot, etc.*). Hello Doctor.

**Dr.:** Please sit down. Fescue, it says here on my chart you are nervous and overgrazed?

**Fescue:** You would be nervous too if you saw your grass complex being taken over by trees and shrubs.

**Dr.:** When did you notice this?

**Fescue:** Remember the fire of 1907? Well, about 40 years after, some trees started moving into my turf. I lost a lot of my grasses and small plant friends as these big thugs started shading out our space.

**Dr.:** You're telling me trees are starting to move into an area that was once your turf and you and your kind can't grow under them?

**Fescue:** They are such hogs. They suck up all the water and don't let the sunshine reach down to the ground. We just can't compete.

**Dr.:** You seem bitter.

**Fescue:** I wish I were bitter. Then all those elk that are chewing at my sweet, tender growth would lay off me.

**Dr.:** So, since the forests have taken over your turf, you've noticed more elk grazing?

**Fescue:** Yes, and come to think of it, I don't see many elk under the trees. Sometimes the elk sleep under the trees, but they come out my way when they're hungry.

**Dr.:** I see. We have a case of shrinking grasslands and overgrazing. Thank you, Fescue.

**Fescue:** (*Exit*).

**Dr.:** Very interesting. Next patient please. Calling Barry the Black-backed Woodpecker.

**Barry:** (*Enter Barry holding belly, smacking lips and looking around for food*). Thanks for seeing me, Doc. You wouldn't have anything to eat, would you? Like a couple of beetle larvae, juicy and white? Mmmm.

**Dr.:** No, I am fresh out. You do seem to be a bit BEAKISH, ha, ha, get it – your big beak ...

**Barry:** Well, it's not getting much use. I am having a hard time finding enough larvae to eat and my family is having a hard time finding a home.

**Dr.:** Tell me, what do you eat?

**Barry:** I drill into trees and eat the larvae of insects that have made their home under the bark.

**Dr.:** There seem to be a number of trees infected with beetles here; I don't understand how you can be hungry.

**Barry:** Have you ever eaten at a recent burn? I mean, there are over 40 different kinds of insects that beeline to fires to get into the fire-killed or stressed trees. It's like a giant all-you-can-eat buffet.

**Dr.:** So, you black-backed woodpeckers actually prefer burned forests?

**Barry:** We, along with our friends the three-toed woodpeckers, really need places that have been recently burned for our grub and for our nesting sites, too.

**Dr.:** Most peculiar. I so rarely see a black-backed woodpecker; I'll have to do some research on you and get back to you.

**Barry:** (*Exit*).

**Dr.:** Last patient please. Dirty Harry.

**Dirty Harry:** (*Enter Dirty Harry – struts in acting very macho, definitely has an attitude*). Make my day, Doc.

**Dr.:** So, you're a soil with an attitude?

**Dirty Harry:** You'd have an attitude too if everyone just used you and never gave anything back. I feel like I am being spread so thin.

**Dr.:** You look a little pale. Are you getting enough nutrients?

**Dirty Harry:** It's tough in this dry climate. Nothing decomposes very quickly. The logs take decades to break down enough to help me build my soil. Yet, everyone wants a piece of me. Trees stick their big roots into my layers. Bushes and small plants take up every inch of me. I give and I give and they just can't give me back my nutrients fast enough.

**Dr.:** So, you need a good boost of calcium, phosphorous and other minerals. I'll get my interns thinking about what might give you a quick boost of minerals. There must be some way to have the plants give back.

**Dirty Harry:** Thanks Doc. (*Exit*).

**Dr.:** Okay interns, let's see what you have listed as problems of poor health in these patients. *Write down their answers on board.*

Can you think of a possible prescription for these patients?

## Possible Prescription

- *Allow students to brainstorm ideas. Fire, logging, or other disturbances may be suggested.*
- *If logging is the chosen prescription, you will want to explain that large-scale logging is not desirable in a national park. Logging is an important economic activity that contributes to the economic and social health of our local communities and our country. Trees also have a significant ecological value, whether they are alive or dead. They fill various roles in the ecosystem: food source, homes for wildlife and nutrients for new growth. Trees have an ecological value that parks are mandated to protect. While logging is a valuable activity elsewhere, large-scale logging within a national park is not an alternative to prescribed fire. A fire puts nutrients back into the soil for new plants to use. The blackened soil of a fire absorbs heat and is rich in newly released minerals. Some plants/trees are stimulated by fire and sprout from underground roots, like aspen. Some species of mushrooms, like morels, flourish in burned areas. Some insects hone in on smoke chemicals to locate burned trees followed by hungry woodpeckers. Thus, fire improves habitat for birds and animals.*

If only a forest could talk, it would make the decisions Parks Canada has to make a lot easier. Healthy forests require diversity and it is natural processes like disease, insects, floods, wind and fire that help create the spaces that support the plant and animal life needed to maintain a healthy forest ecosystem. Humans have been very effective at stopping wildfires and we know that forests need fire. Parks Canada has an active prescribed burn program that reintroduces fire back to forests.

Since it is too risky to let nature take its course and allow wildfires to burn uncontrolled, a program of prescribed fire is used in the mountain national parks. These fires may be started by lightning or by park staff. How they are managed is planned well in advance. Trained fire specialists decide when, where and under what limits such fires will be permitted to burn. They consider weather, type of vegetation, fire behaviour and terrain in order to burn safely and meet ecological goals. Prescribed fire involves some risk; however, it is less than the risk of letting wildfire burn unchecked or trying to exclude all fire. Many of the mountain national parks began controlled burns to restore the natural mosaic of the forest. The objectives of these “prescribed” fires are to restore wildlife habitat and reduce the risk of catastrophic wildfires.

**Evaluation:**

- show same slides over again
- ask students to write what thoughts they now have on fire

See also: ***Fire and Forest Health?*** script for slides

- lightning – *Lightning ignites forest fires in nature; however, we often times put them out!*
- fire in full progress – *Fire is an essential part of a healthy forest ecosystem because it creates a forest with patches of different ages and types of trees. The different patches are habitat for different types of animals. For example, the black-backed woodpecker prefers newly burned forests.*
- Big horn sheep and fire – *Most wildlife are able to escape forest fires, since most fires pass through an area quickly and jump from place to place.*
- close-up shot of tree burning – *For some species of trees like the lodgepole pine, fire is necessary to open up the waxy cones and release the seeds. Only intense heat will do this.*
- blackened soil and trees – *This blackened soil is perfect for helping new seeds to germinate and other plants such as aspen and grasses to get established.*
- growth after a fire – *Once viewed as negative, fire is now seen as an essential part of a healthy forest ecosystem. Parks Canada is reintroducing fire to the landscape because we now know how important it is.*

**Extensions to the Lesson:**

- Field trip to burned forest in a national park or your local area. See Appendix A.
- Additional fire activities. See Appendix B.

## **Suggested Related Resources:**

Parks Canada Fire Fact Sheet series

### ***Web Sites***

Parks Canada: [www.pc.gc.ca](http://www.pc.gc.ca)

Banff National Park Fire Management: [http://www.pc.gc.ca/pn-np/ab/banff/plan/plan8\\_E.asp](http://www.pc.gc.ca/pn-np/ab/banff/plan/plan8_E.asp)

Fire and Disturbance Ecology: [http://www.pc.gc.ca/pn-np/ab/banff/plan/plan8c\\_E.asp](http://www.pc.gc.ca/pn-np/ab/banff/plan/plan8c_E.asp)

Fairholme Range Prescribed Burn: [http://www.pch.gc.ca/pn-np/ab/banff/plan/plan8d3\\_E.asp](http://www.pch.gc.ca/pn-np/ab/banff/plan/plan8d3_E.asp)

Red Deer River Valley Prescribed Burn: [http://www.pc.gc.ca/pn-np/ab/banff/plan/plan8rd1\\_E.asp](http://www.pc.gc.ca/pn-np/ab/banff/plan/plan8rd1_E.asp)

Kootenay National Park: [http://www.pc.gc.ca/pn-np/bc/kootenay/plan/index\\_e.asp](http://www.pc.gc.ca/pn-np/bc/kootenay/plan/index_e.asp)

Yoho National Park: [http://www.pc.gc.ca/pn-np/bc/yoho/plan/index\\_e.asp](http://www.pc.gc.ca/pn-np/bc/yoho/plan/index_e.asp)

Waterton Lakes National Park: [http://www.pc.gc.ca/pn-np/ab/waterton/natcul/natcul1k\\_E.asp](http://www.pc.gc.ca/pn-np/ab/waterton/natcul/natcul1k_E.asp)

Canadian Wildlife Federation: <http://www.wildeducation.org>

### ***Books***

FORCED BC. Name That Tree. Secondary Resource Package.

Mason, Adrienne, et. al. BC Science 7. McGraw-Hill Ryerson, 2004. ISBN 0070947864.

Post, K., A. MacDonald, & C. MacDonald. Wildlife Trees of British Columbia. 2<sup>nd</sup> Edition. K-12 Resource Guide, Wild BC, 1996.

Staniforth, S., et. al. Protected Areas: Preserving Our Future. An Environmental Education Guide to Protecting Natural Areas, K-12. 2<sup>nd</sup> Edition. Province of British Columbia, 2002.

Wild BC. Forests in Focus. K-12 Forest Education Guide, 1999.

These are only a few of the additional resources you may wish to use in order to expand the scope/research for this lesson.

## **Acknowledgements:**

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## **Appendix A: Field Trip**

### **Title: Forest Health – Field Trip**

#### **Overview:**

This field trip is a follow-up to the lesson we did in class. The students will analyze forest health and see how fire contributes to forest health. They will compare burned and unburned areas to see the effects of fire on the forest ecosystem.

#### **Site Specifications:**

Locate a field site containing a recently burned forest (within the past 4-7 years) and an unburned forest. The field site can be located outside a national park. Once at the site, determine the boundaries for activities and test your sample plots (quadrants).

#### **Province and Grade Level:**

British Columbia Grade 7

Alberta Grade 7

#### **List of the Province/Territory and the Related Curriculum Expectations/Competencies/Outcomes:**

British Columbia Grade 7: Life Science – Ecosystems

- analyze the roles of organisms as part of interconnected food webs, populations, communities and ecosystems
- assess survival needs and interactions between organisms and the environment
- assess the requirements for sustaining healthy local ecosystems
- evaluate human impacts on local ecosystems

Alberta Grade 7: Interactions and Ecosystems (Social and Environmental Emphasis)

- investigate and describe relationships between humans and their environments, and identify related issues and scientific questions
- trace and interpret the flow of energy and materials within an ecosystem
- monitor a local environment and assess the impacts of environmental factors on the growth, health and reproduction of organisms in that environment
- describe the relationships between knowledge, decisions, and actions in maintaining life-supporting systems

Alberta Grade 7: Plants for Food and Fibre

- investigate plant uses and identify links between needs, technology, products and impacts (investigate practical problems and issues in maintaining productive plants within sustainable environments; identify questions for further study)

## **Learning Expectations/Competencies/Outcomes for the Lesson Plan:**

To give students an opportunity to use their science investigation skills to analyze how fire contributes to forest health. This is a hands-on look at fire ecology.

Students will:

- get a landscape-scale perspective of biodiversity on their travels to the field trip site
- study a recent prescribed burn or natural burn site to investigate plant regeneration
- compare a fire-suppressed forest with a fire-affected forest
- evaluate the diversity of plants and animal species at the two sites
- share their perspectives, observations and conclusions on the influence fire has on local ecosystems

**Duration:** 2 hours in the field (does not include driving time and landscape biodiversity stop)

## **Required Materials:**

First Aid kit

Cell phone – if you can get coverage

Landscape Biodiversity Stop

- ❑ photographs of landscape mosaics

Burned Area Scavenger Hunt

- ❑ photocopied sheets of *Fire Detectives: Out of the Ashes*
- ❑ pencils for each group
- ❑ closed lodgepole pine cone

Quadrants & Sample Plots

- ❑ measuring tape
- ❑ flagging tape
- ❑ 8 tent pegs
- ❑ 4 hula hoops
- ❑ sheets & pencils
- ❑ tree identification books

## **Teacher Information:**

See Teacher Information from In-Class Lesson Plan.

## **Procedure:**

### **Activities During the Drive to the Field Site**

Use the following text as your guide.

Today we are going to go out into the field to take a look at forest health and fire ecology. It will be an active, fun day. To keep it fun, it is really important that you listen closely. This is for your safety as well as the safekeeping of the natural site we are visiting.

On our bus ride to the site I am going to ask you to look out your windows for a few things:

1. What kinds of forests are you seeing out your window?
2. Are you seeing open areas, meadows, grassy areas?
3. When you look at the forest is it all the same shape and colour? Are the trees tightly spaced?
4. Do you see any evidence of fire or dying trees? Look for red trees, blackened ground and scorched trees.

We will get a chance to stop and look at the landscape and you can share your answers there.

### **Landscape Biodiversity Stop**

Arrive at stop:

*Pull over only if it is safe to do so in a pull-off area and discuss safety. Students are to stay on the side of the pull-off. You will get out first and lead them to the standing area.*

*Once at the viewing site, ask students to hold their hands straight out in front of them with their extended thumbs touching. You should be looking at a forest scene framed in your pointer fingers and thumbs. Do you see a variety of colours? A variety of shapes and sizes? Any open space? Move the frame so you get a new picture. Ask the same questions.*

Does anyone know what a mosaic is? A mosaic is an artistic term that describes a picture made up of different colours and textures. How do these photos look like mosaics?

*Using the photographs of landscape mosaics, ask students if they are witnessing similar mosaic patterns in the pictures they see through their hands, or are they seeing a continuous carpet of green with no patches or variation in colour? What might that say about the landscape's diversity?*

You can think of landscape diversity as interconnected pieces of that picture or mosaic, with the pieces being ecosystems, plants and animal communities, and physical habitats. The pieces are shaped by factors such as aspect (direction the land faces), elevation, and natural forces like avalanches, wind, fire, disease and insects.

Look out there and imagine you're an elk. You are looking for good grass to eat. Do you see any open patches of grass? Imagine you're a black-backed woodpecker longing for a good insect feed that comes after a fire. See any recently burned forest?

Healthy forests will show us a mosaic – different colours, open spaces, closed spaces, younger spaces, and older spaces. The pine marten and pileated woodpeckers thrive in old growth forests, while elk and beaver thrive in a forest with newly emerging plants like aspen and willows.

Some things thrive when there is little diversity. Imagine you're a mountain pine beetle. What do they like? They like old lodgepole pine trees around 80 years old. If you are looking at one continuous forest of lodgepole pines that are all around 80 years old, you're looking at an all-you-can-eat buffet for beetles! Lack of a mosaic makes it easier for insects and diseases to spread, as there are no physical or species breaks. Do you see any brownish-red tree patches? These are trees that mountain pine beetle have already colonized and the trees are dead.

## Field Trip Site

**Duration:** 1.5 – 2 hours

***Note:** Never go into an area burned by crown fire on a windy day. If it is windy, the threat of falling trees is too great for safety. On windy days, skip the scavenger hunt and explore the unburned forest, viewing the burned forest from the perimeter.*

Orientation and rules:

*Gather the group and have them seated on the ground. We are going to have some fun today and we will get to see firsthand some of the things we talked about in class. This field trip is really about using your senses to discover the world of forests. We will start with a fire scavenger hunt. After that, we will do some comparison of a fire-affected forest and a forest that has not seen fire for a long time. At the end of the day you will get a chance to share what you have observed and what your thoughts are on fire and forest health.*

We need to go over some safety issues and then we will get right to it. We are in a wild area. Since we don't want to lose any of you, everyone needs to stay within these physical boundaries. *Point out the physical boundaries. Explain where they should not go – near rivers, roads, etc.*

When I call the group back, it is really important that you quickly finish what you're doing and then head back – making sure all the people in your group are accounted for.

That covers your safety. For the safety of this natural area, please don't pick any plants. If you want help identifying them, call me to your plant. Try not to step on flowering plants. Please don't feed any animals and all of our garbage needs to be taken out.

## ***Fire Detectives***

See attached sheet *Fire Detectives: Out of the Ashes*

Let's start by examining an area affected by fire. *Divide the class into five groups. These groups can stay the same for the whole field trip. Pass out one "Fire Detective: Out of the Ashes" worksheet and pencil per group. You will have 15 minutes to investigate. Please do not pick up anything, as everyone should get a chance to see it. Remember the boundaries of travel. When you're finished come back here and we'll see how you did. Assign some adults to make sure students don't go past the boundaries. At this time, you can go and set up your quadrants and sample plots if you have not done so already.*

*After 15 minutes, or when the groups look like they are losing focus, call them in. See how they did by going over the detective sheets. Ask:*

1. Can you solve the case of how intense the fire was?
2. How long ago did it happen?
3. Are plants and animals present after fire?

*If you have Douglas fir at the site, take the students to the tree to talk about **fire adaptation** (thick bark protects the living tissue from fire). See tree trivia below. See if there are lodgepole tree seedlings. Lodgepole pines are often the first trees to appear in the bare, sunlit soil after a fire. Show them a closed lodgepole pine cone. About half of the lodgepole pine cones are like this cone. It has a hard waxy substance that needs heat to melt the coating. These are called serotinous cones. When a fire opens the cone, seeds are released. This is an example of **fire dependence**.*

## ***Tree Trivia***

### ***Douglas Fir***

Douglas fir is found on moist to very dry sites. They are sometimes referred to as "friendly fir" for their flat, soft needles. The thick bark of the Douglas fir can withstand low intensity fires. These trees can survive for many years. Banff National Park has the oldest known Douglas fir tree in the province, approximately 700 years old!!

### ***White Spruce***

White spruce is found on well drained to moist sites. They are sometimes known as "spiky spruce" because of their sharp, round pointy needles. Aboriginal peoples had many uses for the white spruce tree: dried sap was chewed and boiled and used as a cough syrup; sap was mixed with fat to make salves for treating insect bites, cuts and burns; and the roots were peeled and split to make cord for stitching canoes and making baskets.

### ***Trembling Aspen***

Trembling aspen gets its name from the way the leaves tremble. This trembling motion is made possible by its flat stem (other deciduous trees have round stems). This tree is often the first tree that colonizes a site after the area has been burned. The trembling aspen reproduces by sending up suckers from its extensive, shallow root system. The bark of the tree is photosynthetic: it traps energy from sunlight and stores it in molecules made from carbon dioxide and water. Sometimes it produces a white powdery substance on the bark – a sunscreen for the trees.

### *Lodgepole Pine*

Sometimes known as the “tweezer tree”, the lodgepole pine has needles that are found in pairs and resemble tweezers. They are found in moist to dry sites. Lodgepole pine is a relatively short-lived tree (seldom over 200 years) that thrives in areas that are periodically burned by forest fire. Although these thin-barked trees are easily killed by fire, their cones *require* heat to melt the resin that seals their scales shut. The cone scales open when the resin is softened by a rapid pulse of intense heat from a wildfire (or if exposed to warm summer temperatures for long periods). Once the resin bond has been broken, scales will open slowly over several days, allowing the wind to dislodge and distribute the inner seeds.

The cones and seeds of lodgepole pine are not usually consumed by wildfire because the cones are subject to high heat from rapidly moving wildfires for only a few seconds or minutes. Also, a cone’s internal temperature does not rise instantaneously when heated because its insulating properties resist heating such that heat conducts slowly through the cone’s outer surface. Following a fire, huge amounts of stockpiled seeds are released, producing dense stands of young trees. Most regeneration of lodgepole pine occurs within the first five years after a fire. The patches of exposed mineral soil and thin duff are rapidly filled with plants such that conditions become unsuitable for seed germination after those five years.

### *Sample Plots*

Set up two 20 m x 20 m sample plots (quadrants). Pick areas that are representative of the burned and unburned forest. Using flagging tape, set out your quadrant square 20 m x 20 m. Place a hula hoop within each corner of the large square sample plots.

*Bring the group to the outside of a sample plot and have them sit down. Hand out data sheets for burned forest and unburned forest (see attached sheet). You will be working in the same teams we had for the scavenger hunt. This time, as a group, you will be comparing this burned forest plot with an unburned forest plot. We will look at plant and animal diversity and the structure of the forests.*

Each group will walk through the entire sample plot, staying inside the flagging tape. Record the different tree species and bushes you see within the flagged area. To tell if you’re looking at different species of trees, look at the bark, the needles, and any cones; these things will look different in the different tree species. For bushes: look for colour of bark, shape of leaves, and height of bushes. Record the different species you see. Record any observations.

Each group will also look for plants and animal signs in the hula hoops. I’ll assign each group to one of the hoops. Look for variety: leaf shapes, berries, flowers, and grasses. Also look for insects, scat, and signs of animals and record these findings. We will do this at both the burned and unburned plots and then compare our data.

Let’s start with the burned forest. *Give a brief history of how the fires started and what year. Assign a hoop to each of the four teams and get them started at the hoops. The fifth group will walk through the sample plot. Then switch, so that all the groups have done both a walk through and close observation. When everyone is done, get them all together in the centre of the plot in a big circle, but facing outward. I’d like you all to lie down and look up to the sky and cup your hand like a spotting scope and look through your spotting scope. Keep in mind how much sky*

you are seeing, how much sunshine is reaching you, how much the trees block the sun (or don't). Imagine you're a seedling that really needs the warmth of the sun to grow. *Give them a few minutes to experience this and think about it.*

Now we will do the same thing in the next plot. *Get the students together in the centre of the plot in a big circle, facing outward.* I'd like you all to lie down and look up to the sky and cup your hand like a spotting scope and look through your spotting scope. Compare how much sky you are seeing to the amount you saw in the burned plot. How much sunshine is reaching you, how much the trees block the sun (or don't). Imagine you're a seedling that really needs the warmth of the sun to grow. *Give them some time to experience this and think about it.*

Then get the group together again. Assign a hoop to each of the four teams and get them started. The fifth group will walk through the sample plot. Then switch up, so that all the groups have done both a walk through and close observation, the same thing they did in the last plot.

*Gather the group into a circle to discuss what they've recorded.*

- Was there anything really different between the two plots? Was one easier to move through than the other?
- Any differences in diversity, or in the number of plant species?
- Is there any evidence of animals using one forest plot more than another?
- In which forest did you receive more sunlight when you cupped your hand into a spotting scope?

### **Evaluation:**

- end with Sharing Circle:

*Have the students sit in a large circle.* I'd like to take this opportunity to find about your experience here today. We will go around the circle and each person can share what they learned, what surprised you, what you liked.

### **Extensions to the Lesson:**

Back in the classroom, have each group graph the number of different kinds of herbs, shrubs, and trees (you can separate these into deciduous and coniferous trees) in their plots using a bar graph. The vertical axis could represent the number of species and the horizontal axis could represent the classification of the plants (i.e., herbs, shrubs, trees). Pool the results of the burned and unburned areas to obtain the overall species diversity. Then compare the results from burned and unburned areas.

Have students watch the news or TV to see what kind of language is used when media reports on forest fires. Have them rewrite the media coverage to present a different slant on the story.

## **Suggested Related Resources:**

Parks Canada Fire Fact Sheet series

### ***Web Sites***

Parks Canada: [www.pc.gc.ca](http://www.pc.gc.ca)

Banff National Park Fire Management: [http://www.pc.gc.ca/pn-np/ab/banff/plan/plan8\\_E.asp](http://www.pc.gc.ca/pn-np/ab/banff/plan/plan8_E.asp)

Fire and Disturbance Ecology: [http://www.pc.gc.ca/pn-np/ab/banff/plan/plan8c\\_E.asp](http://www.pc.gc.ca/pn-np/ab/banff/plan/plan8c_E.asp)

Fairholme Range Prescribed Burn: [http://www.pch.gc.ca/pn-np/ab/banff/plan/plan8d3\\_E.asp](http://www.pch.gc.ca/pn-np/ab/banff/plan/plan8d3_E.asp)

Red Deer River Prescribed Burn: [http://www.pc.gc.ca/pn-np/ab/banff/plan/plan8rd1\\_E.asp](http://www.pc.gc.ca/pn-np/ab/banff/plan/plan8rd1_E.asp)

Kootenay National Park: [http://www.pc.gc.ca/pn-np/bc/kootenay/plan/index\\_e.asp](http://www.pc.gc.ca/pn-np/bc/kootenay/plan/index_e.asp)

Yoho National Park: [http://www.pc.gc.ca/pn-np/bc/yoho/plan/index\\_e.asp](http://www.pc.gc.ca/pn-np/bc/yoho/plan/index_e.asp)

Waterton Lakes National Park: [http://www.pc.gc.ca/pn-np/ab/waterton/natcul/natcul1k\\_E.asp](http://www.pc.gc.ca/pn-np/ab/waterton/natcul/natcul1k_E.asp)

Canadian Wildlife Federation: <http://www.wildeducation.org>

### ***Books***

FORED BC. Name That Tree. Secondary Resource Package.

Mason, Adrienne, et. al. BC Science 7. McGraw-Hill Ryerson, 2004. ISBN 0070947864.

Post, K., A. MacDonald, & C. MacDonald. Wildlife Trees of British Columbia. 2<sup>nd</sup> Edition. K-12 Resource Guide, Wild BC, 1996.

Staniforth, S., et. al. Protected Areas: Preserving Our Future. An Environmental Education

Guide to Protecting Natural Areas, K-12. 2<sup>nd</sup> Edition. Province of British Columbia, 2002.

Wild BC. Forests in Focus. K-12 Forest Education Guide, 1999.

These are only a few of the additional resources you may wish to use in order to expand the scope/research for this lesson.

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## Master Sheet for Fire Detectives: Out of the Ashes

### Fire Detectives: Out of the Ashes

**Team Members:** \_\_\_\_\_

See how many of these things you can find in the burned forest. Check them off as you find them, and answer the questions.

1. \_\_\_\_\_ Find a place where the fire burned the tree crowns (the top of the tree).
2. \_\_\_\_\_ Find a place where fire only burned on the ground or the lower trunk of the trees.
3. \_\_\_\_\_ Find a tree that burned, but did not die. Do you know what type of tree it is? \_\_\_\_\_
4. \_\_\_\_\_ Find a tree with a fire scar (blackened patch).
5. \_\_\_\_\_ Find a tree seedling. Do you know what kind of tree it is? \_\_\_\_\_
6. \_\_\_\_\_ How old are the tree seedlings? You can find this out by counting the branch whorls; each whorl equals one year. How old are the new trees? \_\_\_\_\_
7. \_\_\_\_\_ Find some animal droppings (scat) - draw the shape.
8. \_\_\_\_\_ Find evidence of an animal eating plants.
9. \_\_\_\_\_ Find evidence that birds fed on a burned tree.
10. \_\_\_\_\_ Find ash on the forest floor.
11. \_\_\_\_\_ Find a plant sprouting out of ashes.
12. \_\_\_\_\_ Find an open lodgepole pine cone.

## Two Master Sheets for Sample Records

**BURNED FOREST PLOTS**

**NAME OF GROUP:** \_\_\_\_\_

RECORD FOR LARGE SAMPLE PLOT	RECORD FOR SMALL PLOT
<p>1. Counting trees</p> <p>a. total # of trees: _____</p> <p>b. total deciduous trees: _____</p> <p>c. total conifers: _____</p> <p>d. total dead-standing trees: _____</p>	<p>1. Forest Diversity</p> <p>a. # of different grasses? _____</p> <p>b. # of different mosses? _____</p> <p>c. # of different small plants? _____</p> <p>d. # of different bushes? _____</p>
<p>2. Forest Diversity</p> <p>a. # of different conifer species? _____</p> <p>b. # of broad-leaved species? _____</p> <p>c. # of different shrub/bush species? _____</p>	<p>2. Observations</p> <p>a. # of different scats? _____</p> <p>Draw scat shapes:</p> <p>b. Wildlife signs (animals/birds or insects)?</p> <p>c. Tree seedlings?</p>
<p>3. Overall observations</p> <p>a. Wildlife signs (birds/animals/insects)?</p> <p>b. Tree seedlings?</p> <p>c. Anything else you would like to record?</p>	<p>3. Anything else you would like to record?</p>

**UNBURNED FOREST PLOTS****NAME OF GROUP:** \_\_\_\_\_

<b>RECORD FOR LARGE SAMPLE PLOT</b>	<b>RECORD FOR SMALL PLOT</b>
<p>1. Counting trees</p> <p>a. total # of trees: _____</p> <p>b. total deciduous trees: _____</p> <p>c. total conifers: _____</p> <p>d. total dead-standing trees: _____</p>	<p>1. Forest Diversity</p> <p>b. # of different grasses? _____</p> <p>c. # of different mosses? _____</p> <p>d. # of different small plants? _____</p> <p>e. # of different bushes? _____</p>
<p>2. Forest Diversity</p> <p>a. # of different conifer species? _____</p> <p>b. # of broad-leaved species? _____</p> <p>c. # of different shrub/bush species? _____</p>	<p>2. Observations</p> <p>a. # of different scats? _____</p> <p>Draw scat shapes:</p> <p>b. Wildlife signs (animals/birds or insects)?</p> <p>c. Tree seedlings?</p>
<p>3. Overall observations</p> <p>a. Wildlife signs (birds/animals/insects)?</p> <p>b. Tree seedlings?</p> <p>c. Anything else you would like to record?</p>	<p>3. Anything else you would like to record?</p>

## **Appendix B: Additional Extension Activities**

### **Title: Graphing a Fire History – Extension Activity**

#### **Objectives:**

Students will be able to:

1. graph fire data from a variety of sites
2. calculate the fire periodicity of an area
3. discuss the factors that affect fire periodicity

#### **Materials:**

- ☐ archival/recent photos
- ☐ copies of the worksheet as required

#### **Teacher Information:**

You may give out copies of the worksheet as an assignment. Alternatively, you can plot the data on the time line and make a transparency; then use the questions as a basis for class discussion. The data is derived from a graph prepared by J. Parminter of the BC Ministry of Forests and published in *Fire-maintained Ecosystems and the Effects on Forest Ingrowth*, a paper prepared by Don Gayton and published under the Canada Partnership Agreement on Forest Resource Development. The dates were determined using dendrochronology on Douglas fir, ponderosa pine and western larch, all of which are fire-resistant. (Young Douglas firs are not fire-resistant but mature trees are). According to the paper, “[these] forests of pine, fir and larch were subject to fires every five to twenty-five years, which created an open canopy of mature, nearly fire-proof trees and an abundant ground cover of grasses, forbs and shrubs.”

#### **Procedure:**

1. Discuss with the students some of the ways that changes to an ecosystem can be measured: dendrochronology, stories and records, archival photos, etc.
2. Ask what influence they think humans have had on fire history.
3. Ask students about the lifestyle of Aboriginal peoples before European exploration. What did they use for food, clothing, transportation? Are students aware of any ways in which they managed the ecosystem to help maintain the populations of animals on which they depended? Discuss the use of fire.
4. Have students work individually or in groups to complete the worksheets.

**Answers to worksheet questions:**

1. Site 1 - 14 years, Site 2 - 20 years, Site 3 - 22 years, Site 4 - 15 years
2. For 1729-1829, periodicity = 12.5 years; for 1830-1930, periodicity = 25 years
3. The difference might have been due to climatic conditions or it might be a result of Aboriginal burning in the earlier period that decreased when Europeans arrived. The arrival of Europeans brought other fire sources, including sparks from the railway and other sources of accidental ignition.
4. Dendrochronology is the dating of events in an area based on an analysis of tree growth rings.
5. Dendrochronology can reveal information as far back as the oldest tree can be studied.

How many fires occurred since 1909 at each site? Can students suggest why there has been less fire in more recent times?

## STUDENT WORKSHEET

The following data were calculated by a forest researcher in British Columbia. Graph the data by placing a dot **on the line** for each site at the appropriate date.

Site 1: fire dates	1755, 1769, 1791, 1803, 1821, 1822, 1838, 1842, 1859, 1868, 1883, 1895, 1917
Site 2: fire dates	1540, 1595, 1601, 1607, 1618, 1628, 1642, 1695, 1739, 1743, 1767, 1790, 1800, 1830, 1839, 1843, 1851, 1868, 1893, 1900, 1925, 1964
Site 3: fire dates	1628, 1647, 1675, 1688, 1716, 1721, 1730, 1769, 1798, 1818, 1838, 1852, 1875, 1904, 1939
Site 4: fire dates	1729, 1742, 1753, 1760, 1770, 1780, 1796, 1817, 1823, 1841, 1858, 1879, 1908

	Site 1	Site 2	Site 3	Site 4
1980				
1960				
1940				
1920				
1900				
1880				
1860				
1840				
1820				
1800				
1780				
1760				
1740				
1720				
1700				
1680				
1660				
1640				
1620				
1600				
1580				
1560				
1540				

Fires are part of a natural cycle and occur repeatedly at some sites. The average time between fires is known as fire periodicity. To calculate fire periodicity, divide a time span by the number of fires occurring within that time period. **Hint! If a fire occurs at the starting date of the time span, do not include it when you calculate the number of fires.**

Example: On a site, fires occurred on the following dates:

1780, 1791, 1795, 1810, 1843, 1857, 1875, 1905, 1911, 1931, 1980

$$\text{Periodicity} = \frac{\text{time span}}{\text{number of fires minus first fire}} = \frac{200 \text{ years}}{10 \text{ fires}} = 20 \text{ years}$$

1. Calculate fire periodicity for each site. Round off your answer to the nearest year.

Site 1 -

Site 2 -

Site 3 -

Site 4 -

2. Using data from Site 4, determine whether fire periodicity is the same over time or if it varies.

Periodicity for years 1729 - 1829 -

Periodicity for years 1830 - 1930 -

Are the periodicities the same for both time periods?

3. Give two possible explanations for this result.

1.

2.

4. Define dendrochronology.

5. If a researcher was using dendrochronology to determine a fire history, how far back could he/she collect the data?

**Title: Town Hall Meeting – Extension Activity****Objectives:**

Students will be able to:

1. recognize the diversity of opinion about land management practices
2. participate in a model for public discussion of controversial issues
3. develop their own opinions on an issue

**Teacher Information:**

The script presented here simulates a town hall discussion about the development of a fire guard.

**Materials:**

- copies of the script for each participant

**Procedure:**

1. Introduce the idea of a town hall meeting as an opportunity for citizens to present their ideas about community issues.
2. Divide the students into groups to prepare a script of a town hall meeting to discuss the development of a fire guard. You should give them a list of characters from the prepared script. They can add more if they wish.
3. Assign parts in the script and have the students read it over as an example, and then have them prepare their own scripts.
4. Have the participants present their scripts to the other students.
5. Allow discussion afterwards so students can present their own viewpoints.
6. Discuss why it is important to have public discussion on controversial issues.

## **Script: Town Hall Meeting to Discuss Development of a Fire Guard**

### **Setting**

Woodsville is located in a forested park. To keep the town safe, park administrators have recommended that prescribed fire be used to develop a fire guard for the town. Although large-scale logging is not allowed in the park, some business people believe that the regulations should be changed. They feel that logging would be a valuable economic benefit to the park.

### **Characters**

**Mayor (M)** – chairs the meeting and tries to ensure that participants all have a chance to present their opinions.

**Park Ecologist (E)** – has studied the natural ecosystems of the park and also fire management; believes that fuel buildups are dangerous to the town; recognizes that even dead trees are valuable to an ecosystem and that a forest mosaic helps maintain biodiversity.

**Logger (L)** – believes that logging could contribute to the economic value of the park; willing to hire local people to do the work.

**Tour Operator (T)** – doesn't like to see smoky areas during burning or the burned-over areas immediately after a fire; feels it will drive tourists away if forest areas are burned.

**Representative of an environmental group (R)** – wants to see fire restored to the ecosystem; doesn't believe the park should be logged.

**M:** We are having this meeting to talk about a plan to burn some of the forest near the town. First, let's hear about the plan.

**E:** We think that if we burn a strip of the forest near the town – we call it a prescribed burn – it would make the town safer. It would be a good fire guard in case of a wild fire. We will reduce the amount of fuel in the strip so that a wildfire could be stopped at the guard.

**L:** Sure. A fire guard is probably a good idea, but burning wastes wood and causes pollution. Why not let my company cut the wood? It would save you the expense of controlling a fire. I could hire a couple of people – lots of people are looking for jobs. Besides, maybe your fire would get out of control and damage the town.

**T:** That might be a problem. Also, if you burn it, there will be lots of smoke and tourists will be really upset. This town depends on tourists to spend money here. People's jobs depend on the tourist industry. If we need a fire guard, I think logging is better – no smoke.

**R:** Logging is an important economic activity that contributes to the economic and social health of our local communities and our country. Trees also have a significant ecological value, whether they are alive or dead. They fill various roles in the

ecosystem: food source, homes for wildlife and nutrients for new growth. Trees have an ecological value that parks are mandated to protect. While logging is a valuable activity elsewhere, large-scale logging within a national park is not an alternative to prescribed fire. A fire puts nutrients back into the soil for new plants to use. It also improves habitat for birds and animals. That might even bring more tourists into the area after the fire. It won't take long for the burned area to show new plant growth.

*-Characters may add other comments if they wish-*

**M:** Thank you all for your input. We will have to come to a decision soon.